MATHEMATICS D

Paper 4029/01
Paper 1

Key messages

To do well in this paper, candidates need to

- be familiar with all the syllabus content
- be able to carry out basic calculations without a calculator
- understand common mathematical terms
- produce accurate graphs and diagrams
- set out their work in clear, logical steps.

General comments

In general, candidates were well prepared for most of the topics covered on this paper and attempted most of the questions. The topic areas that offered most challenge to candidates were vectors, graphical inequalities, and functions. Candidates would benefit from more experience in answering questions that require an element of problem solving as many found **Questions 7** and **8** difficult to answer.

In most cases candidates showed their method clearly in the answer space for the question and transferred their answer correctly to the answer line. If a method is replaced, candidates should cross out the working that is no longer required as part of their solution to make it clear which working they intend to be marked. Candidates should take care to ensure that their writing is legible and should ensure that numbers such as 1 and 7, and 5 and 6 can be clearly distinguished. Candidates usually had access to the geometrical equipment required to produce a correct diagram.

In a non-calculator paper, it is a key requirement that candidates have good arithmetic skills. Many candidates were able to calculate with fractions. More errors were seen when negative numbers and decimals were involved, particularly dividing by decimals in **Question 1(a)** and **Question 13**. Candidates often made errors when simplifying numeric and algebraic fractions in **Questions 6(b)**, **19** and **25**.

Candidates are expected to understand mathematical terms such as highest common factor and relative frequency. Candidates should know basic geometrical facts such as the number of sides in a hexagon or an octagon.

Comments on specific questions

Question 1

(a) Many good responses were seen for this part. Common incorrect responses included 40 and 400 as final answers.

(b) Many good responses were seen for this part.

Question 2

(a) Many correct answers were seen for this part. Some responses included more than one pair of brackets.

(b) Many good responses were seen for this part, demonstrating the correct application of the order of operations in this calculation involving negative numbers. Complex calculation by expansion was seen in some scripts (for example, $-6 \times -3 + -6 \times 7$) which often resulted in arithmetic errors.

Question 3

Many correct responses were seen for this question. The most common errors were to include the wrong number of zeros or to ignore the negative sign in the power leading to the answer 75 400.

Question 4

(a) Many correct responses were seen for this part.

(b) Few responses clearly distinguished between finding the order of rotational symmetry and finding the number of lines of symmetry. Successful responses came mostly from sketches using tracing paper.

Question 5

Most responses correctly calculated the perimeter of 72 cm. Many responses went on to show a correct method but involved slips in arithmetic calculations. In some cases, 5 or 7 were used as the number of sides in a hexagon.

Question 6

(a) Many good responses were seen for this part. Most used with a common denominator of 15 but others successfully used a common denominator of 45.

(b) Many responses included the step whereby the fraction was changed to a multiplication by writing $\frac{3}{10} \times \frac{1}{6}$. A common mistake seen involved the use of the reciprocal of both fractions or of $\frac{10}{3}$ rather than 6. Some responses included the additional step of converting the correct answer to decimal form which was not required.

Question 7

(a) Many responses did not include the correct application of the formula for the sum interior angles of a pentagon or a quadrilateral. Those who could recall the formula for the interior angles of a polygon usually applied it correctly to reach the answer 108. Many correct answers also came from using the exterior angle of a regular pentagon. It was common to see final answers of 90° or 360°.

(b) Many candidates recognised that the parallel sides mean that the sum of angle x and angle y is 180° and gave an answer that followed through correctly from their answer in **part (a)**. However, many candidates did not answer this part.

Question 8

This question was challenging for many. A common incorrect method was to use 2 + 5 = 7 parts and divide 180 by 7. Some responses attempted to form a method using exterior angles and showed no meaningful progress.

Question 9

Many responses showed three or four of the given numbers correctly rounded to 1 significant figure. In a number of cases, slips were seen in the simplification of $\frac{90}{3}$.

Question 10

(a) Many correct answers were seen, which used either a factor tree or the ladder method. Errors included incorrect division by prime factors omitting one of the factors. Answers occasionally contained numbers which were not prime, including 1.

(b) This part was well attempted by most candidates. Some candidates were able to use their answer to **part (a)** and the given prime factorization of 1512 to find the correct highest common factor. It was also noticed that some candidates not scoring in **part (a)** rewrote 420 as prime factor in **part (b)** and found the HCF correctly.

Question 11

(a) Many candidates understood that the relative frequency for green is found by subtracting the sum of the other relative frequencies from 1. Those that could add the three decimals 0.15, 0.3 and 0.2 correctly to give 0.65 usually reached the correct answer. Many arithmetic errors were seen, which gained the method mark if both the intended addition and the subtraction from 1 were shown.

(b) Many candidates successfully attempted this part. A common wrong answer was 500.

Question 12

(a) Many responses did not correctly represent the inequality on a number line. In some responses, the circles were not drawn properly at the boundary values. Some responses included a straight line with arrows on both ends.

(b) Those candidates who rearranged the inequality to collect the terms in n on the right-hand side of the inequality giving $10 + 5 < 2n + n$ were more successful in reaching the correct answer. The most common mistake seen was a change in the nature of the inequality sign, with $n < 5$ or $n = 5$ often given as the final answer, even when a correct inequality had been seen in the working.

Question 13

Most candidates attempted to use the formula speed = distance ÷ time, but many were not able to correctly convert the units for both distance and time. Those candidates who converted 2600 m to 2.6 km and 12 minutes to $\frac{1}{5}$ hours or 0.2 hours before attempting the speed calculation were often more successful than those who attempted to combine these conversions with the speed calculation. Candidates who reached the calculation speed in km/h = 2.6 ÷ 0.2 were not always able to complete the division correctly and answers of 1.3 and 0.13 were common. Some errors in conversion of units were seen, for example 2600 ÷ 100 rather than 2600 ÷ 1000 or 12 ÷ 3600, or 12 × 60 rather than 12 ÷ 60.

Question 14

(a) Some candidates drew an angle bisector that did not reach *PQ* which was expected for the complete response. Many responses were outside the accuracy required of the question.

(b) (i) Most candidates drew the correct line with bearing 104°.

(ii) Those candidates who had drawn a correct angle bisector and bearing were usually able to measure the line accurately and then use the scale to find the actual distance correctly. Candidates should write down their measurement of the distance as well as their final answer so that it is clear where their answer comes from. Those who wrote down the length of the line they had measured then multiplied it by 20 to reach their final answer gained credit for demonstrating correct use of the scale even when it was unclear which line they had measured. Some candidates were unable to multiply by 20 correctly. Final responses such as $2\,\text{cm}^2 = 400\,\text{m}^2$ or 400 only were seen.

Question 15

(a) Many correct responses were seen for this part.

(b) Few responses scored full marks. Often one of the inequalities $y < 6$ or $x <$ *their* 4.5 was correct, but there were more errors seen in the third inequality.

Question 16

(a) There were many correct responses for this part. However, slips in the sign or the transposition of the *x* and *y* values in the coordinate brackets were seen in many scripts giving final answers, for example, of (–2, 7) or (7, 2).

(b) (i) Many good responses were seen for this part. Some showed a correct calculation of $\frac{13-1}{6--2}$ but made errors when simplifying $\frac{12}{8}$ or when carrying out the subtraction. Many responses gave the equation of the line as the answer rather than its gradient as required.

(ii) This part proved to be very challenging for many, with common errors being to restate the previous gradient, to find its reciprocal, or to change its sign.

Question 17

(a) Many correct responses were seen for this part. Common incorrect answers included x^5, from adding the powers, or $3x^6$.

(b) This part was well answered. A value of *t* of –3 was a common incorrect answer.

(c) This part was well answered. Common incorrect answers included 0,1,5 or $5^{\frac{1}{2}}$.

Question 18

Few fully correct answers were seen for this question. Incorrect formula to connect x and y were often seen. Some responses started from an equation with *x* proportional to $(y + 1)$ rather than $(y + 1)^2$, some started with a correct equation then omitted the square when evaluating *x*, and others set up an equation with *y* proportional to $(x + 1)^2$. Many responses included $\left(4^2+1^2\right)$ instead of $(4+1)^2$.

Question 19

Few fully correct answers were seen for this question. Many of the responses did show the correct method for the expansion of brackets. Few responses showed a fully correct method for solving an equation involving fractions, with many responses omitting the step of writing the fractions in terms of a common denominator. Correct elimination of the fraction and isolation of terms in *x* was rarely seen.

Question 20

(a) Many correct responses were seen for this part. Incorrect responses commonly seen were 0 and 20.

(b) Most candidates drew a correct histogram using their value of *x* found in **part (a)**. Some candidates were unable to calculate the frequency densities for the final two bars. Although the height of 3 was often correct for the third bar, the height of the final bar was sometimes incorrect. Most candidates used correct bar widths, but some started the first bar at $t = 0$, some drew all bars the same width and a small proportion left gaps between the bars. A small number attempted to draw a frequency polygon rather than a histogram.

Question 21

(a) There were few fully correct responses to this part. Some responses showed correct manipulation of the expression involving a fraction. Manipulation to the incorrect subject of formula, slips in the elimination of the fraction or errors in the expansion of brackets were seen. The most common error seen was in the first step of the rearrangement when attempting to eliminate the fraction, writing $2y = 1 + 3x$ rather than the correct $2y = 2 + 3x$ which led to the common incorrect final answer of $\frac{2x-1}{3}$ rather than $\frac{2x-2}{3}$. Methods in which the first step was $y - 1 = \frac{3x}{2}$, isolating the term in *x* before eliminating the fraction, were more likely to reach the correct answer. Common incorrect final answers included $\frac{2x-1}{3}$ or $\frac{x-2}{3}$ or $\frac{x-1}{\frac{3}{2}}$ or $\frac{x-1}{1.5}$.

(b) There were few correct answers to this part. Incorrect calculation of $\mathrm{f}(-4) = \frac{-11}{2}$ was the most common error. Misreading of –4 as 4 was also seen.

Question 22

(a) Many correct answers were seen for this part. Some common wrong responses were $(9p - q)(9p + q)$ *or* $(3p - q)^2$.

(b) Candidates were more successful with the factorisation in this part. Some candidates factorised to the stage $c(a - 3b) + a - 3b$ but were then unable to complete the factorisation correctly because they did not understand that this was equivalent to $c(a - 3b) + 1(a - 3b)$. In some cases, candidates made sign errors when factorising.

Question 23

(a) Many correct responses were seen for this part.

(b) (i) This part was answered well. Some responses processed the matrices incorrectly, giving a 2×2 matrix as the final answer.

(ii) Few responses communicated a clear and unambiguous answer to this part.

Question 24

Candidates found this question very challenging, with very few being able to use the relationship between the sine of an acute and an obtuse angle correctly to find the answer of 130°. Responses of 135, the value midway between 90 and 180, or sin130 were seen.

Question 25

Some candidates were able to correctly factorise both the numerator and the denominator and then cancel common factors to reach the correct answer. It was common to see attempts to factorise the numerator into two brackets, with no further simplification or incorrect simplification. Candidates had more success factorising the denominator but some made sign errors. Common mistakes were to simplify the expression expanded form without factorisation. Some responses showed the cancellation of individual terms without factorising, for example cancelling the x^2 in the numerator and denominator.

Question 26

(a) Very few correct answers were seen for this part. Many candidates were able to state a correct vector route for $\overrightarrow{AC}$. The incorrect use of the ratio was often seen. A common error seen in the working was the statement $\overrightarrow{AC} = \frac{3}{5}(b - a)$.

(b) Most candidates did not attempt this part. Some responses determined vector *DB* correctly but very few were able to follow this by showing that *DB* is a multiple of *OA* and then stating that *DB* and *OA* are parallel.

MATHEMATICS D

Paper 4029/02
Paper 2

Key messages

In order to do well in this paper, candidates need to

- have covered the whole syllabus
- remember necessary formulae and facts
- recognise and carry out correctly the appropriate mathematical procedures for a given situation
- perform calculations accurately.
- show clearly all necessary workings in the appropriate place.

General comments

There were a few well-presented scripts of a good standard. Scripts were seen covering the whole range of marks. Although some candidates did not attempt all questions, most candidates appeared to have sufficient time to complete the paper.

In some cases, candidates gave inaccurate final answers due to premature rounding off in intermediate steps. It is important that candidates avoid premature rounding off and only round off their final answer to three significant figures where appropriate or to the degree of accuracy specified in the question.

Candidates need to be careful when asked to explain a given statement that they do not repeat what has been stated in the question. They are advised to present their workings clearly, showing all stages of working leading to the required result.

Questions 1(c)(i), 3(b), 6(a), 8 were highly scoring whereas **Questions 2(a)(iii), 4(c) (iii), 5(a), 7(b), 9(c), 10(a)(ii)** proved to be difficult for many candidates.

Comments on specific questions

Question 1

(a) (i) Most candidates did not consider the one-hour difference in local time of London and Paris, reaching 14 22. The correct answer 23 01 was commonly seen.

(ii) The majority of the candidates were able to correctly attempt this part.

(b) Few responses resulted in the correct value of *r*. Candidates were not confident about whether they should multiply or divide.

(c) (i) Most candidates were able to score full marks for this part.

(ii) This reverse percentage question was answered well by many candidates. Those responses which did not use a reverse percentage method tended to either reduce or increase $85.68 by 15 per cent.

Question 2

(a) (i) Quite a large number of candidates were able to calculate the mean.

(ii) The correct answer was commonly seen.

(iii) A direct comparison of the numerical values of the mean and the range were mostly seen, rather than their interpretation in terms of the number of tomatoes. . The better responses made a clear comparison, recognising the need to interpret what the range measured.

(b) (i) Many correct cumulative frequency diagrams were seen. However, there were instances where points were plotted at the midpoint of the interval. Other errors included using the information to plot a bar graph.

(ii) Those candidates who successfully attempted **(b)(i**) usually scored well in this part as well. A correct reading at m = 21 was commonly seen. However, some responses proceeded directly to the calculation of the percentage instead of subtracting the reading from the total frequency first.

Question 3

(a) The height of the cuboid was usually found correctly. Not all of the expressions for the area were convincing, given that the answer was quoted.

(b) Both correct values were seen in most answers.

(c) The plotting of points and drawing of a smooth curve were generally well done.

(d) The correct minimum value was seen in most scripts.

(e) Most candidates were able to correctly read their graph at A = 120, but they were not able to obtain the height appropriately.

Question 4

(a) (i) Most candidates were able to list the elements of the given set.

(ii) Responses suggested that the notation n($P' \cap Q$) was not well understood. Many answers listed the elements.

(b) Responses omitted the use of brackets and they commonly wrote $B'(C \cup D)$ as an answer for this part.

(c) (i) Most responses gained partial marks for two correct values in correct position.

(ii) Only few correct responses were seen for this part.

(iii) This was a challenging part that could be interpreted by only a minority of candidates. Many realised that a product of three probabilities would be required here.

Question 5

(a) (i) The majority of responses confused the number of coins and the value of coins. In these cases, the equation $5x + 10y = 130$ was often seen.

(ii) Once again, responses often confused the number of coins and their value.

(iii) Candidates who obtained the required equations did well in this part. However, many responses consisted of a pair of equations with the same coefficients and in those cases, candidates could not proceed further.

(b) Few candidates reached the final answer correct three significant figures. Wrong or incomplete conversion of the number of five-cent coins into dollars was commonly seen with answers of 311 040 000 often seen.

(c) The correct answer for the upper bound of the difference between the length of the two lines was obtained in few cases. Many responses started by finding the difference between the length of the two lines without dealing with the limits first; some gave this as an answer while others attempted to deal with the limits.

Question 6

(a) A reflection in a vertical line was commonly seen.

(b) Many responses gave an incomplete description of transformation Y without triangle C drawn. Conflicting descriptions or the mention of extra transformations were often seen.

Question 7

(a) Many responses were based on the assumption that triangle *BCD* was right angled and used Pythagoras' theorem in this part of the question. Those responses that proceeded with cosine rule were usually successful.

(b) Many responses did not use three-dimensional geometry, with no clear indication that the appropriate right-angled triangle had been isolated.

Question 8

(a) In many scripts, partial marks were scored for one correct term.

(b) Most candidates were able to solve the equation successfully.

(c) (i) The multiplication law of indices was well applied in this part.

(ii) The division law of indices was correctly used.

(d) (i) 43 was commonly seen as the correct answer.

(ii) Many candidates performed well in this part.

(e) The quadratic formula was well used by many candidates but some of them gave both answers correct to two decimal places instead of three significant figures. Mistakes were also seen in the formula but the correct solution was shown, indicating candidates were using their calculators properly.

Question 9

(a) The answer was given. Candidates were expected to write down the component surface areas explicitly before proceeding to the total surface area. Direct evaluation of surface areas was a common error.

(b) Very few correct answers were seen. However, many responses correctly identified the scale factor as 0.74 and multiplied the volume of a sphere or hemisphere by this factor.

(c) Many candidates attempted to use the surface area of the first bowl to find the radius of the second bowl and then calculate the mass of the second bowl rather than use the area factor with their answer to **(b)**. This strategy rarely led to the correct answer. Use of direct proportion was also seen in some cases.

Question 10

(a) (i) Few responses were completely correct. Many responses did not state the angles in the working or in the answer space. Many responses did not provide the correct statement or circle property, or state appropriate pairs of sides or angles without a supporting reason. Several responses referenced only the angles and so could only show that the triangles were similar, not congruent as requested.

(ii) This part proved to be very challenging, with many responses using the given statement to continue with proving the same statement.

(b) Many good responses were seen for this part. Some responses showed an incorrect calculation of the angle *HOG*.